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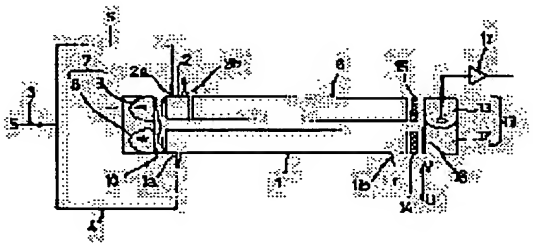
(54) GAS ANALYZER

(57)Abstract:
PURPOSE: To provide a compact and inexpensive infrared gas analyzer in which a same component can be measured accurately from a low concentration region to a high concentration region using only one optical bench.
CONSTITUTION: Two cells 1, 2 having different cell length are disposed in parallel between a light source 7 and a detector 11 and an optical chopper 10 is disposed on the optical path between the light source 7 and the detector 11. A sample gas S is fed constantly between the cells 1 and 2 and the light beam projected from the light source 7 toward the detector 11 is intercepted in the light path on the longer cell side 1 only at the time of measurement of high concentration.



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CLAIMS

[Claim(s)]
[Claim 1] The gas analyzer which prepare a light chopper into the optical path between detectors from the light source, and it is made for sample gas to always flow in both cels, and is characterized by interrupting the beam of light with which cel length faces to a detector from the light source into the optical path by the side of a long cel only at the time of high concentration measurement while preparing in juxtaposition two cels of each other from which cel length differs between the light source and a detector.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to gas analyzers, such as an infrared gas analyzer of non-distributed process input output equipment.
[0002]
[Description of the Prior Art] The infrared gas analyzer of non-distributed process input output equipment is luminous-intensity I which penetrated the cel, if Lambert-Beer's law is made into radical Motohara ** and concentration of k and a measuring object component is set to C for the absorbance multiplier which becomes settled by l, measurement wavelength, and the measuring object component about I0 and cel length (effective cel length) in the reinforcement of the incident light to a cel. I=I0 e-kCl .... (1)
It is expressed with the becoming formula.
[0003] Therefore, the relation of the concentration of a measuring object component and the output in this kind of gas analyzer be difficult for the deflection of the curve A showing an output become large as be show in drawing 5 and the concentration of a measuring object component become high, and there be a fixed limitation in high concentration measurement from the relation of the linearity of output characteristics for this reason, and measure the same component with a sufficient precision from the low concentration field of ppm level to the high concentration field of % level.
[0004] Then, in order to measure the same component with a sufficient precision from a low concentration field to a high concentration field The long cel optical bench BL for low concentration range which cel length as shows drawing 6 (A) equipped with the comparatively long cel (henceforth a long cel) as one technique, As equipment for measuring a high concentration field, cel length as shows in this drawing (B) was preparing both short cel optical bench BS for high concentration range equipped with the comparatively short cel (henceforth a short cel).
[0005] In addition, for 61, as for a detector and 63, in drawing 6 (A) and (B), the source of infrared light and 62 are [a light chopper and 64] light filters. Moreover, 65 and 66 are the sample cels by which introductory supply of the sample gas S is carried out, and the cel length of one sample cel 65 is larger than that of the sample cel 66 of another side. And 67 and 68 are the reference cells prepared according to the die length of each sample cels 65 and 66, and reference gas, such as zero gas, is enclosed.
[0006] As shown in drawing 7 , as other technique moreover, between the source 71 of infrared light, and a detector 72 By connecting two Mikata solenoid valves 75 and 76 to a serial, and opening and closing these Mikata solenoid valves 75 and 76 suitably, while carrying out serial arrangement of the short cel 73 and the long cel 74 optically When measuring a low concentration field, sample gas S is supplied only to the long cel 74. Purge gas P, such as zero gas which does not absorb infrared light, is supplied to the short cel 73, and conversely, when measuring a high concentration field, sample gas S is supplied only to the short cel 73, purge gas P is supplied to the long cel 74, and there are some which were constituted so that only one cel might be used for measurement.
[0007]
[Problem(s) to be Solved by the Invention] However, in the configuration shown in above-mentioned drawing 6 , there is un-arranging [of the configuration of equipment being enlarged and becoming a cost rise from the place in which two optical benches BL and BS are formed].
[0008] Moreover, in the configuration shown in above-mentioned drawing 7 , although it has been somewhat improved also in respect of cost while unlike what was shown in drawing 6 being able to measure by the single optical bench and miniaturizing the configuration of equipment somewhat, there were following un-arranging. namely, the configuration of drawing 7 -- if it is, when either the low concentration field or the high concentration field is measured, purge gas P must be supplied to the cel with which measurement is not presented, and purge gas is needed for it in addition to sample gas S.
[0009] Moreover, although change supply of purge gas must be performed when switching, for example from measurement of a low concentration field to measurement of a high concentration field, this change takes most time amount and there is inconvenient [that a range change cannot be performed in an instant]. This means that it cannot respond in an instant, when switching to the so-called direct measurement mode measured as it is without diluting exhaust gas from the so-called dilution measurement mode which dilutes and measures the exhaust gas from an automobile and switching to dilution measurement mode from direct measurement mode conversely.
[0010] This invention was made with careful attention to the above-mentioned matter, and aims at offering the cheap and compact gas analyzer which can measure the same component with a broad and sufficient precision from

shutter 16 is shown in drawing 1 , the light-receiving room 12 corresponding to the long cel 1 of the capacitor microphone mold detector 11 is made into a protection-from-light condition, and only the light-receiving room 13 corresponding to the short cel 2 is made into a light-receiving condition. And from the capacitor microphone mold detector 11, it is CO2 by irradiating cels 1 and 2 and introducing sample gas S to the same timing to cels 1 and 2 by the condition of rotating the light chopper 10 on the proper frequency, by the sources 8 and 9 of infrared light. It is CO2 at that time like [the AC signal showing concentration is outputted and] the case where it is a ****. Concentration is displayed on a concentration indicator.

[0022] In this case, since the short cel 2 is used, l in the aforementioned (1) formula becomes small, therefore a high concentration field can be measured with high degree of accuracy.

[0023] And in the case of which [of measurement of a low concentration field, and measurement of a high concentration field], it also sets so that I may be understood from above-mentioned explanation. Sample gas S is supplied to the both sides of the long cel 1 and the short cel 2, and a shutter 14 is moved in the predetermined direction only at the time of measurement of a high concentration field, it shades the light-receiving room 13 corresponding to the optical path by the side of the long cel 1, and he is trying to intercept for it the infrared light which goes to the light-receiving room 13 from the source 8 of infrared light. Therefore, it sets in the mode which has measured the low concentration field, and is CO2 by a certain cause. If it is made to perform change actuation of a shutter 16 while performing a range change at this time since a concentration indicator serves as the so-called scale over when concentration rises and it increases rapidly on % level, it can switch to measurement of a high concentration field from measurement of a low concentration field in an instant.

[0024] Moreover, contrary to the above, when having measured the high concentration field, it is CO2. When concentration falls to ppm level small, it can switch to measurement of a low concentration field from measurement of a high concentration field similarly in an instant.

[0025] That is, it is CO2 while observing the output of a detector according to this invention. Even if concentration changes a lot, this can be followed immediately, measurement mode can be switched and a measurement range can be switched to a low concentration field from the high concentration field from a low concentration field, or a high concentration field.

[0026] Drawing 2 shows the infrared gas analyzer concerning the 2nd example of this invention. In this example, while making it the discrete-type light source which separated the sources 8 and 9 of infrared light as the light source section 7, the light chopper 10 is formed in the side far from the sources 8 and 9 of infrared light of cels 1 and 2. According to this configuration, the tooth-space cel 6 is omissible.

[0027] Drawing 3 shows the infrared gas analyzer concerning the 2nd example of this invention. The long cel 1 and the short cel 2 are connected in the connection passage 18, and the long cel 1 and the short cel 2 are made for sample gas S to flow in series in this example. according to this configuration, compared with the thing of 2 conventional optical bench methods, a configuration is markedly alike and is simplified. In addition, it is also applicable to the configuration of said drawing 1 that it is the same as that of this example.

[0028] Drawing 4 shows the infrared gas analyzer concerning the 4th example of this invention. It sets in this example and solid state detectors, such as a semiconductor detector, are used as a detector. That is, in drawing 4 , 19 is a solid state detector and 20 is a light guide block. This light guide block 20 is guided so that incidence of the infrared light which passed the long cel 1 and the short cel 2 may be carried out to the single solid state detector 19, it is the hollow object which consists of aluminum, and while that inner skin 20a is formed in a solid state detector 19 side from cel 1 and 2 side at the taper of tapered form voice, mirror plane finishing of it is carried out. And a shutter 16 is the front face of the light guide block 20, and it is formed so that the optical path by the side of the long cel 1 can be intercepted or opened.

[0029] Since actuation of the infrared gas analyzer of the above 2nd - the 4th example is the same as the 1st example, the explanation is omitted.

[0030] It cannot be overemphasized that this invention is applicable not only to an above-mentioned infrared gas analyzer but other gas analyzers, such as an ultraviolet gas analyzer.

[0031]

[Effect of the Invention] As explained above, according to the gas analyzer of this invention, the same component can be measured with a broad and sufficient precision from a low concentration field to a high concentration field by the optical bench of one **. And while simple [of the configuration] is carried out and it becomes compact, a manufacturing cost is also reduced sharply. Moreover, it is not necessary to pass purge gas etc. and a running cost is also reduced.

[0032] Furthermore, in the gas analyzer of this invention, there is an outstanding advantage that continuous measurement can be performed only by a range change and the change of a shutter location, without interrupting measurement, even if it switches from the condition which has diluted and measured the exhaust gas of an automobile, for example to the condition of having measured said exhaust gas in the raw state, suddenly.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram showing the 1st example of this invention.
[Drawing 2] It is the block diagram showing the 2nd example of this invention.
[Drawing 3] It is the block diagram showing the 3rd example of this invention.
[Drawing 4] It is the block diagram showing the 4th example of this invention.
[Drawing 5] It is drawing showing the relation of the concentration of a measuring object component and the output in a gas analyzer.
[Drawing 6] It is drawing for explaining the conventional technique.
[Drawing 7] It is drawing for explaining the conventional technique.
[Description of Notations]
1 2 [— A detector, S / — Sample gas.] — 8 A cel, 9 — The light source, 10 — 11 A light chopper, 19

[Translation done.]

a low concentration field to a high concentration field by the optical bench of one **.
[0011]
[Means for Solving the Problem] It is constituted so that the beam of light which faces to a detector from the light source into the optical path by the side of a cel with cel length prepare a light chopper into the optical path between the light source and a detector while preparing in juxtaposition two cels of each other from which, as for the gas analyzer of this invention, cel length differs between the light source and a detector in order to attain the above-mentioned purpose, make it sample gas always flow in both cels, and long only at the time of high concentration measurement may be interrupted.
[0012]
[Function] In the gas analyzer of the above-mentioned configuration, when measuring a low concentration field, for example, the optical path of a long cel and a short cel is not shaded by the shutter, but in order to switch to measurement of a high concentration field from this condition, the optical path by the side of a long cel is shaded with a shutter. ON light only of the beam of light which passed the short cel is carried out to a detector by this, and a desired detector output is obtained.
[0013]
[Example] Drawing 1 shows the infrared gas analyzer concerning the 1st example of this invention. In this drawing, 1 and 2 are the long cels and short cels by which introductory supply of the sample gas S is carried out, and are arranged mutually at juxtaposition. Although not illustrated in a detail, and cels 1 and 2 While the closure is carried out by the aperture material which the both ends become from an infrared permeability ingredient The inlets 1a and 2a of sample gas S, derivation opening 1b, and 2b are prepared, and the sample gas inlets 1a and 2a are connected to the passage 4 and 5 which branched to two, respectively in the other end of the sample gas passageway 3 which stands in a row in the source of sample gas (not shown).
[0014] 6 is a tooth-space cel for making equal the cel length by the side of the long cel 1 and the short cel 2, it is optically arranged with the short cel 2 at a serial, and while the closure is carried out by the aperture material which both ends become from an infrared permeability ingredient, the zero gas which does not perform infrared absorption, such as nitrogen gas and argon gas, is enclosed with the interior. In addition, the larger one of the cel length ratio of the tooth-space cel 6 to this short cel 2 is desirable, for example, it is ten to about 500.
[0015] 7 is the light source section prepared in one aperture side of cels 1 and 2, and consists of what unified two sources 8 and 9 of infrared light which irradiate cels 1 and 2, respectively. 10 is the light chopper prepared between the sources 8 and 9 of infrared light, and cels 1 and 2, and a rotation drive is carried out by the motor which is not illustrated. 11 is the capacitor microphone mold detector formed in the aperture side of another side of cels 1 and 6, and the two light-receiving rooms 12 and 13 are arranged so that it may correspond to cels 1 and 6, respectively. the light filter with which 14 and 15 were prepared just before the light-receiving rooms 12 and 13 — it is — for example, a measuring object component — CO2 it is — the time — CO2 It consists of a multilayers interference filter which passes only the infrared light of an absorption wavelength band.
[0016] And 16 is the shutter formed in the front face of the entrance window of the light-receiving room 12 corresponding to the long cel 1, and intercepts or opens the optical path by the side of the long cel 1. When a slide in the direction of arrow-head UV in drawing is free for this shutter 16 and this moves in the direction of arrow-head U suitably, namely, the light-receiving room 12 It will be in the light-receiving condition in which the infrared light which came out of the source 8 of infrared light, and passed the long cel 1 carries out incidence to the light-receiving room 12, it moves in the direction of arrow-head V from this light-receiving condition, and when it changes into the condition which shows in drawing 1 , said infrared light has the incidence to the light-receiving room 12 interrupted, and the light-receiving room 12 will be in a protection-from-light condition.
[0017] In addition, 17 is the pre amplifier formed in the output side of the capacitor microphone mold detector 11, and the output side is connected to the signal-processing section which is not illustrated.
[0018] Next, the infrared gas analyzer constituted as mentioned above is used, for example, it is CO2 in the exhaust gas of an automobile. The case where concentration is measured is explained.
[0019] First, CO2 in sample gas S Concentration is comparatively low, when it is ppm level, while moving a shutter 16 in the direction of arrow-head U and changing two light-receiving rooms 12 and 13 of the capacitor microphone mold detector 11 into a light-receiving condition, cels 1 and 2 are irradiated by the sources 8 and 9 of infrared light, and a light chopper 10 is rotated on a proper frequency. When sample gas S is introduced to the same timing to cels 1 and 2 by this condition, from the capacitor microphone mold detector 11, it is CO2. The AC signal showing concentration is outputted. And it is sent to the signal-processing section which is not illustrated through pre amplifier 17, predetermined signal processing is performed, and this AC signal is CO2 at that time. It is displayed on the concentration indicator which concentration is not illustrating.
[0020] In this case, it is CO2 in the short cel 2 since the cel length ratio of the tooth-space cel 6 to the short cel 2 is large, therefore the short cel 2 is quite short compared with the long cel 1. Most absorbed amounts can be disregarded and achieve the so-called duty of a reference cell. This has the so-called advantage of a double beam (2 light source). That is, since two optical paths can be balanced by optical adjustment etc., the vibrating membrane of the capacitor microphone mold detector 11 changes into a neutral condition mostly, therefore the background can be made small compared with a single beam (one cel and one light source), it becomes possible to suppress the effect of the background when the amount of signals in a low concentration field is small, and highly precise measurement can be performed.
[0021] Next, CO2 in sample gas S Concentration is quite high, when it is % level, it sets to the condition that a